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ORCHARD SPRAYING

By

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THE EXTENSION SERVICE SERVES THE STATE

Raleigh and West Raleigh, North Carolina

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Formulas and Directions. Spray Outfits, etc.

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YIELD OF ONE TREE
ONE HALF NOT SPRAYED. THE OTHER HALF SPRAYED
NOT SPRAYED
SPRAYED
FROM WINESAP TREE ON FARM OF J.H.SHARP. R.D.6. GREENSBORO, N.C.
EXHIBIT DOES NOT INCLUDE WINDFALLS AND CROP WAS LIGHT.
SPRAYED HALF WAS TREATED APRIL 28, JUNE 3 AND JULY 9, (1913)
FRUIT PICKED SEPT. 15, (1913).
DIFFERENCE DUE ENTIRELY TO SPRAYING.

FIG. 1.

ORCHARD SPRAYING

By Franklin Sherman,
Chief in Entomology

A WORD TO NORTH CAROLINA FRUIT-GROWERS AND TO COUNTY FARM AGENTS

This circular places before you the best and safest advice we are able to
er on Orchard Spraying.
New methods and materials are being developed every year in great number,
ecially by enterprising spray-chemical firms. We could not possibly test all
se with the care necessary to render careful judgment.
The Grower should follow the standard recognized methods in his general
atments, testing the new things in a limited way in his own orchard if he
ires, but he should not hastily abandon a safe and tried program to place
ire dependence on any process which is new and unknown to him.
The County Agents should be especially conservative in recommending new
aying procedure. Stand by the tested, proven, accepted methods, which are
lained in this circular. The second part of this circular gives an account
Orchard Spraying Demonstrations, in which the methods here given were
owed. Notice the testimony of the growers, some of whom may be per-
al acquaintances of yours.
scores of growers (and many county agents) have learned to do efficient
k in Orchard Spraying from publications like this circular. The whole
cess has been so thoroughly proven and established, and is so carefully
lained in these pages, that any intelligent grower, and any county agent,
uld be able to proceed with this work.
o get the best and most certain results one must study the matter so that
will have a clear plan in mind; will know how often he will spray, at what
es, and just what he is spraying for.
he whole matter is presented in these pages as simply as we know how.
Explanation of Photograph. The year was 1913. The unsprayed half of
tree (north half) matured *nine marketable apples*, while the sprayed
uth) half matured *three pecks of marketable apples*. This was in 1913,
n the crop was poor.
n 1914 we used the same tree and the same methods again, but changed
es, spraying the north half and leaving the south half unsprayed. The
lt was that the unsprayed (south) half matured *one barrel* of marketable
les, while the sprayed (north) half matured *two barrels* of marketable
les. That was in 1914 when the crop was good.
n both years the spraying returned a very high profit—proportionally
ter when the crop was poor, but actually greater when the crop was good.
both halves of this *same tree* were tested separately in the two years.
rchard spraying by standard methods is not an "experiment."

PART 1—ORCHARD SPRAYING

INTRODUCTION

The call for information on the spraying of fruit trees is very active, a each year many take up the work who have not done it before. Also ma of the county farm agents are adopting this as a part of their public wo This is as it should be, for the matter has been so often proven that it truly an "Extension" activity, which farm agents may well advocate in fruit orchards of more than family size; and in family orchards also if owner takes sufficient interest in his fruit to do the work.

"Please give me full directions for spraying my orchard." That is a co mon form of inquiry, and while we give much of the information needed these pages, yet the grower must remember that there are many small deta that can be mastered only by experience and observation.

The recommendations as given in this circular are based not only on own experiences and observations, and the experience of growers in the Sta but also on the recommendations of the officials in the United States Depa ment of Agriculture. We feel sure, therefore, that they are as near corr as they can be made from present knowledge. In this circular we give pref ence to arsenate of lead as the poison to use in spraying fruit trees, as resu from its use are much better than from Paris green. The recent tendency to lessen the amount of arsenate used.

SPRAYING FRUIT TREES

Insect pests and diseases of various kinds make it necessary to spray fruit orchards. Examine our fruits in summer or fall and notice the kno dwarfed, wormy and specked ones, and you will be convinced. However, so of the diseases and insects which attack the *apple* are quite different fr those which attack the *peach*, so that the spraying schedule is different these two fruits.

Pears are subject to nearly the same troubles as apples, but do not suf so much from them, and spraying does not generally give such good prof Plums, on the other hand, have almost exactly the same enemies as the pe and require practically the same treatment.

Spraying and Bees.—The honey-bee is one of the chief agents in polleniz our fruits, and we should use every reasonable care to do them no ha If spraying is done at exactly the proper times there should be no trouble this point, for no spraying is advised when the trees are in bloom. The ch difficulty lies in the fact that many growers begin the spraying for Codl Moth while the trees are in bloom in order to finish in time. This is necessary and is harmful. If the grower will wait until all or practically of the blossoms have fallen before using the poisoned sprays, he will have j as good results against Codling Moth or Curculio, and will have better resu from the pollenization. If the trees be sprayed while they are in bloom pollen is wetted so that the pollenization is less perfect, and the petals of blossoms themselves are in the way, so that the spray does not readily re the blossom end.

The interests of both the fruit-grower and the bee-keeper are in agreeme It is a mistake for the grower to spray when the blossoms are still on trees. Indeed, so long as there are enough active and fragrant blossoms attract bees in any number it is too early to spray for Codling Moth or C culio. Wait until the apple blossoms *have fallen*, and then spray promp With peaches spray about a week after the blossoms fall.

SPRAYING SCHEDULE FOR APPLES

› give a good all-round protection requires from three to five sprayings season, as follows:

Winter Spraying.—Use Commercial Lime-sulphur at rate of 1 gallon to llons water (see page 11), or, if you prefer, you may make your own e-sulphur at strength of 15 pounds lime, 15 pounds of sulphur to 50 gallons r (see pages 12 and 13), or the material known as "Scalecide" may be , 1 gallon to 15 gallons water (see page 12), or use the other forms of ble Oil.

is winter treatment is especialy for San Jose Scale. If this pest is not bling you, you need not use this treatment every year; but it has such a general effect on the trees that it is best to use it every few years anyway.

Just Before Blossoms Open.—Use Commercial Lime-sulphur at rate of gallons to 50 gallons water and add 1 pound of Arsenate of Lead powder, pounds if the paste arsenate is used. (Page 11.)

the orchard is (or was the previous year) badly infested with aphids on eaves and young twigs, the tobacco extract preparation known as "Black 40" may be added to the mixture in this second spraying, at rate of nt to 50 gallons of spray. (See page 13.)

is spray is to control the first caterpillars which attack the leaves, the disease of the fruit, and aphids if the Black Leaf 40 is added.

general we regard this spray as the least important of the schedule, but more needed in orchards where aphis is serious.

Just After Blossoms Fall, Promptly.—Use Commercial Lime-sulphur gallons to 50 gallons water and add 1 pound Arsenate of Lead powder— pounds if the paste arsenate is used (page 11).

is is the *most important spraying* of all the *fruit*, and should *never be cted* in bearing orchards. Its special object is to kill the Codling Moth h makes the "wormy apple," and as the worm usually enters at the om end we must spray promptly after the blossoms fall, as the blossom s then open and will receive the poison. All the trees will not shed the oms at the same time, so we must strike at the best time for the average, r the ones we prize most, and every effort must be made to lodge some of pray in the open blossom end of each young apple.

Three to Four Weeks Later.—Use the Poisoned Bordeaux Mixture at of 4 pounds Lime, 3 pounds Bluestone, to 50 gallons water, and add 1 d Arsenate of Lead powder, or 2 pounds if the paste arsenate is used. e 13.)

is treatment, coming three or four weeks after the blossoms have fallen, be when the apples are about an inch in diameter, more or less. It will some Codling Moth worms which escaped the third treatment, and will Caterpillars which may have started since.

the leaves will be nearly grown, this treatment will benefit them for the of the season. It also protects the fruit considerably from rots which k it later in the season, and it is the most important treatment in con- ng the "Blotch" disease.

ght here a word of caution is needed. Some want to use the weakened -sulphur (as in the third spraying) instead of the Bordeaux. All right hose who prefer; it will do very well, but Bordeaux will give a little r protection against Bitter Rot and other mid-summer diseases than the ened Lime-sulphur. If bluestone is scarce and high, the amount may be ed to 2 pounds in making 50 gallons.

Summer Spraying.—Ten weeks later. Use the same as in the previous ment.

is treatment should come in July, and will prevent the diseases that attack eaves and fruit late in the season, such as Bitter Rot, and the rotting of

the fruit on the trees in the warm days of early fall. This midsummer sp
ing is more important here than in some other sections of the United St
and it is more needed in the warmer sections of the State than in our hig
and coolest locations.

NOTE.—Plant disease men assert that the Bitter Rot disease may be so
sistent as to call for two or even three, special summer sprayings with
deaux, but if additional sprayings are given the arsenate may be omitted.

This schedule names five spraying treatments (and indicates possible
of more), and is intended for the man who wishes to do a thorough jo
order to be assured of getting a high quality of fruit. The man who is
particular may reduce the schedule to four sprayings, to three, or perhap
only two, but for each such omission he must expect to have less pe
results. The two most vital treatments are: the spraying *just after the bl
falls* (promptly), which should never be neglected in bearing orchards,
the *winter spraying*, which is to control scale-insects and for the gen
health of the tree. If "Blotch" disease is prevalent the spraying 3
weeks after blooms fall (No. 4 of the schedule) is important.

Young Trees.— Apple trees which are not yet in bearing do not nee
many spraying treatments. If scale-insects are present they should be g
the winter spraying, and this may well be given to young trees every se
year anyway for its general good effects. They will also benefit by spra
once when the leaves are nearly grown (sooner if caterpillars show the ne
using either the diluted lime-sulphur (No. 3 of schedule), or the Borde
(No. 4 of schedule), in either case adding the arsenate as shown in
schedule, to control caterpillars.

SPRAYING OF APPLES REDUCED TO SIMPLEST TERMS

There are a good many growers who would like to get good fruit and w
be willing to go to some expense to get it, but who simply will not bothe
change from one material to another, to memorize a lot of formulas, and
the strengths of the mixtures. These persons want to know of some
spraying treatment which they can adopt with reasonable success, and
are willing to take slightly poorer results if by so doing they can bring
matter down to a basis of easy simplicity.

For all such persons we recommend the Commercial Lime-sulphur at
gallons to 50 gallons water, with 1 pound of Arsenate of Lead powder—
pounds if the paste arsenate is used. (Page 11.)

If this material be used for all spraying treatments, winter and summe
will come as near giving satisfaction as any *one* material. It is not neces
to use the arsenate of lead in winter applications, but only when ther
fruit or foliage on the trees.

This material is strong enough so that if used several times through
season it will be somewhat effective against the San José Scale; it gives
protection from fungous diseases; the sulphur is quite effective against suc
insects, such as plant lice and scale-insects, and the arsenate makes it effe
against the Codling Moth, Curculio, and leaf-eating insects. But if in
of this scale-insects become destructive, then the regular winter spraying
be given.

SPRAYING OF PEARS

Pear orchards generally do not require so much spraying treatmen
apples, though their pests are quite similar. As a rule, two treatments
stand them in good stead—first, the winter treatment (No. 1), (if the orc
has scale), and, second, the treatment after the blossoms fall (No. 3).
the pear grower must remember that the Fire Blight, which is perhaps the
greatest enemy to the pear grower, is not reached by any spraying app

. Some pear growers do not spray at all except when special occasion s. The Kieffer variety is generally more resistant to pests than the 's, and it is seldom attacked by San Jose Scale.

SPRAYING SCHEDULE FOR PEACHES (AND PLUMS)

sults from spraying peaches are less certain than with apples, but with ixtures and methods now in use they are more certain than ever before. control of San José Scale is relatively simple, and the control of Curculio ot are reasonably satisfactory, by the schedule here recommended. But if n be warm and rainy so as to wash off the spray, the Circulio and rot be destructive despite our best efforts.

system of spraying treatments which will give splendid results in average is as follows:

Winter Spraying.—Use Commercial Lime-sulphur at rate of 1 gallon to lons water (see page 11), or, if you prefer, you may make your own -sulphur wash at strength of 15 pounds lime, 15 pounds sulphur, 50 gallons r (see pages 12 and 13), or the material known as "Scalecide" may be 1 gallon to 15 gallons water (see page 12).

is treatment is for the San José Scale, which is very destructive in many orchards of the State. If the scale is not present, then this treatment e omitted, but it has such good general effect on the tree that it ought to ed every two or three years anyway. If the scale is present, it should ed every year. It helps against leaf-curl and rot.

A Week After Petals Fall.—Use the self-boiled Lime-sulphur Wash (8 ls lime, 8 pounds sulphur, 50 gallons water), and add 1 pound of Arsenate ad powder—or 2 pounds if paste arsenate is used. (See page 14.)

tice that here we recommend the self-boiled lime-sulphur, and not the ercial material.

is treatment is especially for the Curculio, which makes the worm at the and it also prevents leaf-curl, rot, and other troubles to considerable t. It should be given when about two-thirds of the young peach is free the "shuck" of the bloom.

Two Weeks Later.—Use same as in the previous treatment.

About a Month Before Due to Ripen.—Same as the previous treatment, se no arsenate of lead.

is last treatment is needed only for Elberta and varieties later than ta. The varieties which ripen earlier than Elberta will usually be well cted by the three treatments before mentioned.

arsenate of lead be used in this latest treatment, it will, from our expe- e, give better color to the fruit, but it is not necessary so far as Curculio ncerned.

RE.—We have tested the spraying of peaches with the Commercial Lime- ur at 1 gallon to 50 gallons water with the arsenate of lead, in place of elf-boiled wash, for the second, third and fourth sprayings. We have l that while it may occasionally give good result without injury, yet its nued and regular use will injure the trees, killing limbs and preventing ormation of fruit buds. We insist that it should not be depended upon reatments when there is fruit or foliage on the trees, that at best it d only be employed in emergency when for some reason the self-boiled is impracticable, and it should not be used more than once in the same n.

ung Trees.—Peach trees which are not yet in bearing do not need so spraying treatments. If scale-insects are present they should be given the r spraying, and this may well be given to young trees every second year ay for its general good effects. If caterpillars, beetles, leaf-curl disease,

etc., do damage after the leaves are out, the trees may be sprayed pron with the self-boiled lime-sulphur with the arsenate added, or if aphis ap on young growth the "Black Leaf 40" may be used at rate of ½ pint gallons of water, or of self-boiled lime-sulphur.

Spraying of Peaches (and Plums) Reduced to Simplest Terms

If the grower would rather adopt merely *one* material for use on peach plum trees, even though the results be not always perfect, he will find tha best material is the *self-boiled Lime-sulphur (8 pounds lime, 8 pounds sul 50 gallons water) adding 1 pound arsenate of lead powder, or 2 poun paste arsenate is used.* (Page 14.) The arsenate need be added onl treatments when there is fruit or foliage on the trees.

If this material be used three or four times during the season at the t mentioned, it will give quite good protection, though San Jose Scale occasionally make it necessary to give the regular winter spraying.

DUSTING IN PLACE OF LIQUID SPRAYING

Dry powdered preparations, to be applied with special dusting appar are now being advocated to replace the long-established process of li spraying in orchards. This matter has been most discussed, and teste the apple-growing sections of the north, where insect and disease condi are somewhat similar to the mountain section of North Carolina. It is being tested on peaches in Georgia, and in this State. Dusting methods long been used for vegetables.

From a consideration of the testimony it is evident that the dusting me permits more rapid work and at less cost, but it appears that in seasons insects or diseases (especially the "scab" disease) are especially bad results from dusting are not so certain as from the liquid spraying. The re are not all in agreement; some have secured good results and others secured poor results, so that the judgment here expressed is intended summary from many opinions.

We feel that for North Carolina, only a fruit-grower thoroughly experie in liquid spraying should undertake the dusting methods, and then only limited way at first (depending on liquid sprays for his main treatmen meantime) until he shall prove for himself and to his own satisfaction, w method he wishes to follow.

AS TO NEW METHODS, AND NEW MATERIALS IN GENERAL

There is room for much personal opinion and preference in adopting processes. In preparing a circular like this, which is intended for the u persons in all parts of a diversified State, most of whom are concerned orchards of 2,000 trees or less, and whose labor is not highly skilled o average, our inclination is to be conservative, and our advice is to sti the standard proven methods which are known to be profitable, and to safe" about discarding these for less tried methods.

The art of treating orchards for insects and diseases has made very progress in the last 25 years. Where there were only a few manufacture spray-apparatus and spray-materials a few years ago there are scores t and every year new types of nozzles, pumps, dusting apparatus, and new of spray-chemicals and dust-preparations are placed on the market in number. The tendency is for the manufacturer to be more and more ca of his good name in pushing new things. Many of the large firms employ who have expert knowledge of insects and diseases. for the express purpo keeping them from going astray in their recommendations, and often

conduct public tests or demonstrations. All this is to the advantage of
areful grower.
could not attempt to make official tests of all the new things that are
ated; such tests would form a basis for discontent by reliable firms
truly worthy goods might fall a fraction below some other in any
year. To repeat the tests year after year would multiply the whole
and meanwhile any material could be slightly modified and put forward
serving of renewed test. To undertake such testing work adequately
be to become merely an agent for manufactured articles.
North Carolina grower of limited experience should learn, adopt, and
d upon, the established methods of insect and disease control, testing
deas in a small way if at all, or depending upon others of more experi-
o do so, or leaving it to the manufacturers to demonstrate on their own
nsibility.

THE SPRAY MIXTURES AND THEIR PREPARATION

work of preparing spraying mixtures has been greatly simplified by
ommercial sprays and washes now on the market, which are as good or
imes better than the grower can prepare for himself. On page 16 will
nd a list of firms that deal in spraying materials.

Commercial Lime-sulphur Wash

commercial lime-sulphur washes can be bought ready-made from the
facturers or from dealers in larger towns. Most of them are of about
me strength, and can be reduced to proper strength for spraying merely
ding water.
winter use against San José Scale use 1 gallon of commercial lime-
ur to 8 or 10 gallons of water.
use in spring and summer on foliage and fruit of apples, use only 1½
s of commercial lime-sulphur to 50 gallons (one barrel) of water. It is
ecommended for use on peach and plum after buds are open.
s generally more convenient, and perhaps a little better, to put the water
keg or barrel first and then pour in the lime-sulphur liquid and stir
hole together thoroughly.
enate of lead may be added to the lime-sulphur for use in spring and
er on foliage and fruit of apples, and should be used at rate of 1
l to 50 gallons if the *powdered* arsenate is used, or 2 pounds to 50 gallons
paste arsenate is used. It must be remembered that the lime-sulphur
, while excellent against fungous diseases and scale-insects, is not
ive against Codling Moth and Curculio; for them the poison (arsenate of
must be added. Dip out a pailful of the liquid and stir the arsenate in
il it is thoroughly dissolved into the solution, then pour back and stir.

Home-made "Concentrated" Lime-sulphur

(For large orchardists)

ne extensive fruit-growers prefer to make their own *concentrated* lime-
ur, similar to the commercial material, storing it in barrels and diluting
h water for use in spraying season. This can be prepared during fall or
r so as to have the material ready by time to give the winter spraying.
s same home-made "concentrated" lime-sulphur may be used in place of
ommercial" for spring and summer sprayings on apple (treatments 2 and
he schedule), following the same proportions.

As this process can best be followed by use of a steam boiler or large co ing vat, and calls for rather larger quantities of lime and sulphur, we rega it as mainly suitable to those who have from 2,000 to 3,000 trees or more.

The directions as here given are adapted from Farmers Bulletin 650 U. Department of Agriculture (Washington, D. C.) by Prof. A. L. Quaintan Interested growers should get this free publication for more detailed inf mation.

The following formula will give a solution of a density of from 32 to degrees by the Baume scale:

Fresh stone lime	80 pounds
Commercial ground sulphur	160 pounds
Water to make, of finished product	50 gallons

Place enough water in the cooking vessel to finish with 50 gallons of solution; bring water to boiling, put in the lime and immediately add sulphur. If there is a mechanical agitator it should be started when the li and sulphur are added, otherwise the mixture must be stirred vigorously hand until the lime is slaked, and necessary agitation must be given throu out the cooking. Boil by fire or steam for one hour from time of putting the lime and sulphur. Draw off the solution as soon as cooking is comple (stirring while drawing off) and run it through a 30-mesh strainer into barrels. The insoluble material which settles in the barrels afterwards not be objectionable in spraying provided it has been properly strained.

Soluble Sulphur Compounds

There are now offered for sale dry powdered compounds of sulphur wh dissolve in water, and are recommended for winter spraying to control sc (but not for summer spraying). These are more convenient in handling, there is a saving in freight. Some growers prefer to use them, but it largely a question of personal preference. Care should be taken to sift powder slowly into the water and to stir constantly while it is being added, there shall be no lumps to clog the pump or spray nozzle. Our own limi experience with this has been satisfactory.

"Scalecide" and "Soluble Oils."

"Scalecide" is the trade name of a manufactured oil preparation which made its way into common use as a material for winter spraying. It has advantage of spreading readily into cracks and crevices, and is less disag able to use than the lime-sulphur, and many growers prefer it for th reasons. It is declared to have considerable effect in controlling fung diseases. It mixes readily with water and is used at the rate of 1 gallon 15 gallons of water.

Several firms manufacture oil-preparations which mix with water and recommended for winter-spraying. These come under the general head Soluble Oils or Micible Oils. They have the advantage of spreading m readily into crevices than the lime-sulphur and of being less disagreeable work with. Use according to maker's directions.

Home-made Lime-sulphur Wash

Some growers still prefer to make their own lime-sulphur wash for winter spraying, therefore we give the formula and directions for it:

Stone lime (unslaked)	15 pounds
Sulphur (flowers)	15 pounds
Water (to make)	50 gallons

at from 4 to 6 gallons of water to boiling over fire in large iron or brass
. Mix the sulphur with enough hot water to make a thin paste and
it into the kettle with the hot water. Now add the lime, part at a time,
is it slakes dash in a little cold water as needed, to keep it from boiling
or to keep it from becoming dry. Keep the fire going and stir the mixture
ently. As the slaking ceases, keep it boiling from the fire for half an
longer, then dilute with water (cold is all right) to make 50 gallons;
1 through a fine wire screen or cloth to remove all sediment, and spray.
s wash, which contains 15 pounds sulphur to the barrel, *is only for use in*
r when the trees are dormant. It is an excellent remedy for San José
, but all treatments with it should be finished before the buds open in
g. The later the treatment is made the better, just so the buds are not

"Black Leaf 40"

s is the trade name of a manufactured tobacco-extract preparation which
ıade its way into common use, especially against aphids. It can be used
e dilute lime-sulphur on apples for the second spraying in the schedule,
the third if necessary. Use at rate of ½ pint to 50 gallons of spray.

Poisoned Bordeaux Mixture

Stone lime (unslaked)	4 pounds
Bluestone (copper-sulphate, blue vitriol)	3 pounds
Water	50 gallons

Arsenate of lead, 1 pound of powder, or 2 pounds if paste arsenate is used.

the bluestone in a cloth and hang it in a tub or keg of water so that it
t below the surface. In this way it will dissolve much more rapidly than
own in so that it sinks to the bottom. Warm or hot water will dissolve
ch more rapidly than cold. Put this to dissolve the evening before it is
ied to spray and it will be dissolved by morning. This should be in a
n receptacle. After the bluestone has dissolved, add water to make 25
ıs (if there is not that amount already).
ke the lime slowly (preferably with hot water), and when completely
l add water to make 25 gallons. Keep this in a separate keg or barrel.
now have 25 gallons of bluestone solution and 25 gallons of the lime solu-
We now take equal parts of each of these solutions and pour them to-
into a third tub or barrel. Do not pour a bucketful of one into a half-
of the other, but mix them always in equal quantities. Thus we may take
ater buckets and fill one with the lime solution and the other from the
one solution and then pour them both at the same time into the third bar-
keg. This little point of always mixing them in equal quantities results
etter mixture than when they are carelessly mixed, or when the whole
of one solution is poured bodily into the whole mass of the other. Always
ıe solution well before dipping out, so that the liquid you take out shall
ly charged with the ingredients of the solution.

ling the Poison.—The arsenate of lead is first dissolved in enough water
ke it liquid and is then stirred into the Bordeaux Mixture.

ain Before Using.—Before using, the mixture must be carefully strained
gh a cloth or fine wire gauze. Remember that all the spray must come
rough the small hole in the end of the nozzle; therefore, to avoid clogging,
carefully before using. Care in the thorough straining before spraying
ay for the trouble many times over. If one uses considerable quantities
mixture, it is well to have a large funnel strainer made, fitted with two

nettings, one of iron wire window-screening and the other with much fi gauze, preferably of brass. Having the poisoned mixture, it is ready to ap

Use of Poisoned Bordeaux Mixture on Other Crops.—The poisoned B deaux Mixture has such a wide range of usefulness aside from its use apples, that we feel that this feature should be briefly mentioned here.

It is the one material recommended for regular application to Irish potat cluster grapes (not scuppernongs), tomatoes, melons, cucumbers, and e plant.

Tests of this material on Irish potatoes, conducted by this office over seve years at the Mountain Branch Station at Swannanoa (Buncombe Count N. C., have shown that five sprayings will give an *increased yield* in aver years of from 40 to 60 bushels of potatoes per acre, and observations indic that with the early-crop potatoes grown in the eastern part of the State, increase from three sprayings is from 20 to 30 bushels per acre. (Extens Circular No. 48 on "Spraying Irish Potatoes" will be sent on application.)

Bunch grapes should be sprayed with the poisoned Bordeaux when fruits are well "set," other applications to follow about three weeks ap from two to five sprayings in all.

Tomatoes, egg-plant, cucumber, and melons are all sprayed much the sa as potatoes, from two to five times, beginning when plants are well star and repeating often enough to keep new growth protected from beetles, wor blights, rust, etc. Spraying is *not* a remedy for "wilt" disease.

It should be remembered that the arsenate of lead is used in this mixture kill insects which eat foliage or fruit (potato beetles, caterpillars, flea-bee melon-beetles, etc.). Hence it may not *always* be necessary to add the a nate, but on potatoes the beetles are usually so persistent that it should included every time.

The Bordeaux Mixture, even without the poison added, protects plants fr many kinds of blight, rust and rot, and it also has a decided stimulat effect upon the growth, a sort of tonic effect, though it is not a fertilizer.

Self-boiled Lime-sulphur Wash, with Arsenate

This is the material to use on peaches in all treatments when there is fr or foliage on the trees. Some growers use it on apples instead of Borde or commercial washes. The slaking lime does the boiling, no fire being u in boiling the wash itself, though hot water is used in slaking the lime.

Stone lime (unslaked)	8 pounds
Sulphur	8 pounds
Water (to make)	50 gallons

Arsenate of lead, 1 pound of powder, or 2 pounds if paste arsenate is used.

Place the lime in tub or barrel and pour over it enough hot water to cove Put in the sulphur (lumps first crushed) and add another bucket of wa As the mass boils from the slaking of the lime stir it, add more hot water needed to form a thick paste at first, and then gradually a thin paste. A s or blanket over the barrel helps to keep in the heat. When the boiling is over add water (cold is all right) to make 50 gallons, stir thoroughly strain it carefully.

Adding the Poison.—Dissolve the arsenate of lead paste in enough of solution to make it liquid, then stir it into the whole solution, and you ready to spray.

Home-made Oil and Soap Sprays

Kerosene Emulsion.—This was once the standard remedy for all kinds of le insects and for most plant lice, but now it has been replaced by the ne-sulphur Wash and ready-made oil preparations as a remedy for San é Scale. It is still often used against plant lice and some soft-shell scale ects, though for this purpose it has been largely replaced by the tobacco parations. When carefully made and applied as a fine misty spray, it is a y effective insecticide.

'or use on Peach and Plum, we advise that it be used at a strength not ater than 15 per cent oil for treatments in winter and early spring, and stronger than 10 per cent oil in summer.

'or use on Apple and Pear, it may be used as strong as 25 per cent, or n 50 per cent oil in winter and until the buds open in spring; but after the s have opened, we advise that it be used not stronger than 15 per cent oil. ne growers have used pure kerosene (without any water at all) and have l good results without injury to trees, but this is dangerous to trees, ex- sive at best, and is not advisable.

lere is the usual formula for preparing the Kerosene Emulsion, together h statement of amounts of water to be added to get 10 per cent, or 15 per t, or 25 per cent, or 50 per cent, of oil:

Kerosene (coal oil)	2 gallons
Laundry or soft soap	½ pound
Water	1 gallon

have the soap into thin pieces in the water and heat to boiling over fire stir to dissolve the soap. Then *remove from the fire* and pour in the 2 ons of oil, and churn the whole mixture together vigorously for several utes. This may be done by pumping it through the spray pump, directing nozzle back into mixture so that it is sprayed back into itself again. After whole mass has been thoroughly churned together it will be of a light my nature, and will then mix readily with even cold water. This gives a total of *three* gallons, two gallons of which (or 66 per cent) is oil. To ce this down to the proportions desired, observe the following table:

To get 10 per cent oil, add 17 gallons of water
To get 15 per cent oil, add 10 gallons of water
To get 25 per cent oil, add 5 gallons of water
To get 50 per cent oil, add 1 gallon of water

desired, the emulsion may be prepared in less (or greater) quantity than indicated, but care must be taken to carefully follow the *proportions* here n, so that the final mixture that is sprayed on the trees will be of the red strength—not more and not less. It often requires a little experience skill in making the mixture and a thorough understanding of how much er to add to reduce the mixture to the strength desired. It must be embered that this remedy only affects those insects that are actually ted by it; hence the application must be very thorough.

oap Solution.—For many kinds of aphids (plant-lice) we have found a ng solution of ordinary soap in water to be quite effectual. We have used successfully against the Black Peach Aphis, Cabbage Aphis, Rose Aphis, a number of others. We believe it might well be used in orchard work n the "Black Leaf 40" is not available.

Laundry soap	1 pound
Water	4 gallons

Shave the soap into thin pieces in one-half the quantity of water. Heat t boiling and stir to dissolve the soap. Then add the rest of the water (cold and spray while warm.

SPRAYING CHEMICALS

Lime.—For spraying work it should be the fresh unslaked ("stone") lim If this cannot be had the powdered air-slaked lime *can* be used, but must b carefully sifted and lumps crushed, and twice as much by weight should b used.

Bluestone.—Known also as "copper-sulphate" and "blue vitriol." Can b had at any drug store, but can be secured more cheaply or ordering in quan tity from some wholesale firm.

Paris Green.—Found in most general stores.

Arsenate of Lead.—Preferred to Paris green for spraying. Now kept b many dealers in this State. Made in two forms, powder and paste. Th powdered form is gaining in use for spraying. Formulas for preparing spra mixtures in this circular allow for use of either form.

We are often asked if the paste form can be used after it has become co siderably dry and hardened. In our own work we have used this, but usin a *somewhat* less amount by weight (depending upon the degree of dryness and using special pains to see that it is all reduced to liquid in the spra solution, by working it into a moist lump in the hands and gradually workin it in the liquid in our hands until it all dissolves out between the fingers, the stirring thoroughly and straining carefully.

Sulphur.—There are two grades of sulphur: "flour of sulphur" and "flowe of sulphur." For making the Lime-sulphur Wash the "flowers" is considere better, but either may be used. Sulphur may be ordered through any dru firm, and some general stores handle it or can order it.

Other Materials.—The other spraying materials mentioned in this Circul —soap, oil, etc.,—can be easily procured everywhere at varying rates. Th ready-made preparations may be secured from dealers or ordered from th makers.

Commercial Manufacturers and Dealers

Following are the names and addresses of some manufacturers of sprayin chemicals:

James A. Blanchard Co., 30 Church St., New York City. General line spray materials.

General Chemical Co., 25 Broad St., New York City. General line. "O chard Brand."

Vreeland Chemical Mfg. Co., 50 Church St., New York City. General lin

Niagara Sprayer Co., Middleport, N. Y. General line.

Grasselli Chemical Co., Guardian Building, Cleveland, Ohio. General li (not Paris green).

B. G. Pratt Co., 50 Church St., New York City. "Scalecide" and oth materials.

Fred. L. Lavenburg Co., 100 William St., New York City. Arsenate Lea Paris green.

Bowker Insecticide Co., 1011 Fidelity Building, Baltimore, Md. "Pyrox Arsenate Lead, Lime-sulphur.

Merrimac Chemical Co., 33 Broad St., Boston, Mass. Swift's Arsenate Lea

Corona Chemical Co., Milwaukee, Wis. "Corona Dry" powdered Arsena Lead.

American Tobacco Products Co., Louisville, Ky. "Black Leaf 40."

James Good, 2111 E. Susquehanna Ave., Philadelphia, Pa. Fish Oil Soap

SPRAYING APPARATUS

2—Bucket Pump; ger hose and ex- sion pipe needed orchard work.

What is the best spray pump? That is a question often asked, and entirely impossible to answer with any assurance of satisfaction. Some growers get along very nicely with the small bucket pumps (for small home orchards), while others quickly abandon them for the larger and more powerful kinds. Some (especially gardeners and truckers) prefer the knapsack pumps, while others say that they wouldn't have one, as they are too hard to work with. Some like the compressed-air sprayers that are carried about by hand (many are in use among tobacco growers), while others object that they hold too little liquid and that too much time is required in filling the tank every few minutes.

There is just one invariable rule that can be laid down, and that one holds good regardless of whether you are rich or poor, and that is, *get a good, strong, durable pump—large enough and strong enough and with enough hose and extension pipe to reach every part of your trees with a fine, misty spray.* It is also a great advantage if the pump has an agitator for keeping the liquid stirred so the ingredients will not settle to the bottom.

arrel Pumps for Standard.— Considering *everything*—the cost, the durity, the capacity, the labor we have, the kinds of fruit and the size of our ıards, we believe that for the majority of our people who have or are ıting orchards for market purposes the barrel pumps are best, and should generally considered as the standard. Those with orchards of 1,000 or e apple or 3,000 or more peach may profitably get more elaborate outfits, le those with only about 50 apple or 100 peach (or less) may do all right n the smaller pumps.

good barrel pump, with two leads of hose, extension pipes, double nozzles, cocks, etc., will cost, complete and ready for use, about $25 to $35. It sually better to order that the pump be fitted into the *side* of the barrel. ou get the pump alone and fit it into the barrel yourself it will cost less. improvement, but costing more, is a barrel pump, which sits on platform rely outside of barrel, worked by long-lever handle.

Manufacturers and Dealers in Spray Outfits

will be well to write to any or all thee following firms and ask for their strated catalogues and price-lists of spraying outfits, study them carefully, re on the length of hose, extension pipe, etc., before placing your order.

number of dealers in this State carry spray pumps in stock.

ydnor Pump and Well Company, Richmond, Va.
ould Manufacturing Company, Seneca Falls, N. Y.
riend Manufacturing Company, Gosport, N. Y.
urst Manufacturing Company, Canton, Ohio.
orrill & Morley, Benton Harbor, Mich.
C. Brown Company, Rochester, N. Y.
ramotor Company, Buffalo, N. Y.

FIG. 3.—Barrel pump fitted in side of barrel with two leads of hose, two extension rods, each with stopcock at base and double nozzles at end. A good general type of barrel outfit. (After Hurst Mfg. Co.)

Appliances.— Aside from selecting good pump, you must also decide ho much *hose* you want, how long an *e tension pipe* will be needed, and th kind of *nozzle*. You must also sta that you want whatever *connection washers, etc.*, will be needed to put th entire outfit in condition for use. will also be an advantage to have *stopcock at base of the extension pip* so the spray can be cut off at any m ment to prevent waste. All these litt appliances add more or less to the cos but a suitable arrangement of them the very making of a satisfactory ou fit.

For bucket, knapsack and co pressed-air pumps, from six to ten fe of extra hose is enough, but for barr pumps we advise at least fifteen fe of extra hose. The extension pi should be six to ten feet long, accor ing to the size of trees.

We prefer a nozzle which throws a cone-shaped spray and which is s *at an angle* so as to permit greater range of work. Many of these detai the grower can decide for himself better than any one can decide for hi by a study of the catalogues, or from individual experience.

Our larger growers, like the peach-growers in the "Sand Hill" section North Carolina, and the larger apple-growers in the western section, who orchards contain from 5,000 to 40,000 trees, may well consider the power ou fits, operated by gas engine attached to the spray tank. For those also su improvements as "cluster-nozzles" and the "Nu-System Spray Gun" (Gou Manufacturing Company) are worthy of attention and trial.

4.—Power Spraying outfit in operation in large peach orchard, "sand-hill section" of North Carolina, 1914.

FIG. 5.—Power Spraying outfits in operation in large apple orchard, Haywood County, N. C., 1914.

PART 2—SPRAYING DEMONSTRATIONS

PROOF OF VALUE OF SPRAYING

For several years the Division of Entomology conducted public demonstr
tions in the spraying of orchard trees—especially apples.

These demonstrations were repeated in so many years, and in every secti
of the State (east, middle, and west), until the general results cannot p
sibly be a matter of chance, and these results prove beyond dispute that t
spraying of apples is profitable in all sections of the State.

County Farm Agents in many counties are to be commended for havi
taken up this work, for, when done in the manner prescribed in this Circul
it will almost invariably give striking results which are pleasing to t
grower and to the credit of the agent.

These demonstrations were made in the orchards of actual growers, a
were advertised so that all who desired could be present and learn exac
how the work was done. A barrel spraying outfit was taken to each pla
and the spray mixtures were made up in the presence of the audience.
each case three or four trees of good bearing size and age were selected a
all treatments were given exactly as should be done in regular orchard pr
tice. Not a single thing was done nor a single implement used that is n
entirely practicable for the ordinary fruit grower of moderate or small mea
We simply put science to the test on a practical job, and it justified the clai
made for it.

At most places one tree was sprayed on only one side, the other side rece
ing only what was accidentally blown or thrown upon it. This was to see
we could demonstrate the difference between the sprayed and unspray
halves of the same tree. In most cases we have carried the work throu
two or three sprayings, but in others gave only the one treatment to show h
the work was done.

Of all the demonstrations that were followed out there were only t
that failed to give noticeably good results, these being at Mocksville, Da
County, and Rutherfordton, in Rutherford County, both in 1909.

Where Work Was Done.— The places at which demonstrations were ma
followed by later treatments (including 1912), and from which we receiv
reports by the owners, are listed below. In addition to these, we have gi
single demonstrations (not followed by later treatments) at a number of ot
places. This does not include demonstrations since 1912.

County—Locality	Owner of Orch
Alamance, Burlington, R. 7	L. W. H
Alexander, Poors Knob	R. B. Lo
Bertie, Aulander	C. H. W
Cabarrus, Concord, R. 5	G. F. Barnha
Caldwell, Lenoir	J. A. D
Caldwell, Lenoir, R. 3	S. N. Swan
Caldwell, Adako	J. T. Perk
Catawba, Hickory	L. J. Yo
Cleveland, Shelby	L. S. Hamr
Cleveland, Casar	Zero M
Davie, Mocksville	J. D. Hod
Guilford, Greensboro, R. 1	D. W. Rams
Henderson, Dana	Jonathan C
Iredell, Mooresville, R. 1	H. C. Johns
Jackson, Sylva	George P. Mi

nston, Clayton.....W. T. Stallings
coln, Reepsville.....D. C. Warlick
Dowell, Old Fort.....H. M. Croom
chell, Spruce Pine.....H. F. Lawrence
ieson, Red Springs.....W. M. Roberts
van, Salisbury.....M. J. Bost
herford, Rutherfordton.....M. O. Dickerson
tland, Laurinburg.....W. DeB. McEachin
nly, Albemarle, R. 3.....Dr. D. P. Whitley
xes, King.....J. W. Spainhour
kin, Courtney.....D. T. Reavis
cey, Bald Creek.....C. L. McPeters

1 the fall, we wrote to each of these persons, asking for their observations opinions of the results. The following is a fair sample of the letter which sent to all, and it will be noted that our letter was so expressed as to draw *same kind* of statement from all; this was done so that we could *fairly pare* the reports.

(*Letter Asking Results of Demonstration Spraying*)

RALEIGH, N. C., November 3, 1911.

Y DEAR SIR:—As the season is now at a close, we desire to know the result he work in spraying apples at your place this year. Please, therefore, e me as soon as convenient, stating what difference there was between sprayed trees and the unsprayed ones, both as to quantity and quality of t and foliage. Also please indicate whether you notice any difference in two halves of the tree which was half sprayed.

inclose envelope for your reply, also circular which gives a number of e reports for previous years, so you can see the kind of information we t. We want to know exactly how it resulted, whether favorable or not.

Very truly yours,
FRANKLIN SHERMAN, JR.,
Entomologist.

esults.—Following are the reports made by these growers. Bear in mind in no case did we give more than three sprayings, and had it been prac- ble for us to give a summer spraying the results would doubtless have been better than here shown.

(ALAMANCE COUNTY) BURLINGTON, N. C., October 20, 1909.

EAR SIR:—The foliage on the sprayed trees is green and fresh, while on the rs there is scarcely a leaf. On the tree that was half sprayed the fruit twice as large and perfect, while on the unsprayed side it was small and ior. It did not look as if there could be so much difference. Many have ed the difference in passing and asked the cause. I am convinced, and re others, that we will have to spray. Very truly,

L. W. HOLT.

(ALEXANDER COUNTY) POORS KNOB, N. C., October 13, 1908.

EAR SIR:—Your work here was very satisfactory, as the foliage is yet n, while the trees near by that were not sprayed have lost most all their ge. The fruit is much larger and nicer and less infested with worms. half tree that was sprayed is bright and green and the fruit is fine, while pposite side (not sprayed) has lost very near all its foliage. All parties have seen those trees say there is a great difference between the trees were sprayed and the ones that were not. * * *

Very truly yours, R. B. LOWE.

(Bertie County) Aulander, N. C., November 23, 1909.

Dear Sir:—The apples on the sprayed trees were some larger and about per cent better than the others, and on the half-sprayed tree the part that w sprayed was at least 75 per cent better than the unsprayed part.

C. F. Warf.

(Cabarrus County) Concord, N. C., November 25, 1912.

Dear Sir:—Your letter received. The results were simply wonderful. T apples were larger than previous years, and very uniform in size, sound a dollar and hanging on the trees until picked off just before the first killi frost.

The foliage remained perfectly green until killed by frost early in Nove ber. The difference on the tree sprayed on one side was also very marked the apples on the unsprayed part being very inferior, dropping off in July a August, while those on the sprayed part of the tree remained until pick just before frost. Yours very truly,

G. F. Barnhardt.

(Caldwell County) Lenoir, N. C. October 7, 1908.

My dear Sir:—In regard to the apple trees your department sprayed la spring and summer. The foliage is still (October 7) green and healthy, a the apples still hanging on the trees, sound and free from worms and b ter rot.

The variety sprayed is my seedling, Dula Beauty. One-half of one tree w sprayed and the other half, which was not sprayed, shed its leaves and fr more than three weeks since, and the fruit is on the ground rotten; and th is the condition of a large part of my orchard. I hope that the demonstrati on my place will emphasize the importance of spraying to obtain sound fru It is no longer an experiment. Respectfully, J. A. Dula.

(Caldwell County) R. 3. Lenoir, N. C., November 7, 1911.

Dear Sir:—Your work here was very satisfactory. The foliage is still gre and healthy, and the apples still hanging on the trees, while the unspray trees near by have lost their foliage and the fruit did not amount to anythi All persons who have seen those trees say there is a great difference betwe the trees that were sprayed and the ones that were not.

Yours truly, S. N. Swanson.

(Caldwell County) Adako, N. C., October 6, 1910.

Dear Sir:—Your work here was very satisfactory, as the foliage is green, while unsprayed trees have lost most all their foliage. The fruit much larger and nicer and less infested with worms. The half tree that w sprayed is bright and green and the fruit is good, while the side not spray has lost all its foliage. Most every one that was here at the demonstrati and have watched the trees say they are going to get spraying outfits for ne year.

With best wishes, etc., S. O. Perkins (for J. T. Perkins).

(Catawba County) Hickory, N. C., November 17, 1909.

Dear Sir:—The apples (Limbertwigs) have been gathered, and I am su that the trees that were sprayed gave more apples and better apples than t unsprayed trees, and held a green foliage longer. The apples were alm free from worms and did not rot near so bad as the apples of the unspray trees. They were very much improved in color and size.

Yours truly, L. J. Youn

(Cleveland County) Shelby, N. C., December 10, 1909.

Dear Sir:—Your work here was very satisfactory, as the foliage on Nove ber 15th was green on the trees that were sprayed, while the unsprayed tr had shed their foliage. The Shockley tree that was sprayed held its fr much better and it was smoother and much larger than the (unsprayed) t near by. The tree that was half sprayed showed marked difference—t fruit on the sprayed side was smooth and much larger, while on the side sprayed the fruit rotted and was shedding all summer. L. S. Hamrick.

(Cleveland County) Casar, N. C., November 12, 1911.

AR SIR:—I beg to state that the sprayed trees did not have more than a
1 apples on them, but of a better quality than the unsprayed trees and
ayed half-tree. Yes, quite a difference in fruit and foliage of sprayed
insprayed trees. Zero Mull.

(Davie County.)

NOTE.—This is one of the few where no special benefit was noticed.)

Mocksville, N. C., October 23, 1909.

AR MR. SHERMAN:—The tree fully sprayed had no fruit on it. The foliage
red to be fresher green than the unsprayed until late in September, when
ected the difference to be more manifest, but I could scarcely detect any
ence.
e tree half sprayed was a winesap full of fruit. There was some ap-
t difference in favor of the sprayed half until late in season, when there
d to be little or none. The apples on both the sprayed and unsprayed
were good and free from worms. Yours truly, J. D. Hodges.

(Guilford County) R. 1, Greensboro, N. C., November 12, 1909.

R SIR:—The apple trees sprayed on my place showed a decided improve-
the Ben Davis was the finest I ever saw, so full, nearly free from rot,
ung on so long, while the fruit on the unsprayed tree right by it rotted
ll off so that we got scarcely any good from them. The Winesap, how-
had no fruit, but the foliage was greener and more free from brown
The neighbors seemed very much interested in the work all summer.
Respectfully, D. W. Ramseur.

(Henderson County) Dana, N. C., November 11, 1908.

R SIR:—The Limbertwig apples have been gathered and marketed, and I
re that the trees that were sprayed gave double the real value that three
corresponding ones (unsprayed) gave. More apples and better apples
e result.
trees held a green foliage for about three weeks longer than those that
not sprayed, and the apples were almost free from worms and defects.
olor was very much improved and the size larger and almost twice the
r of bushels on the trees sprayed than there were on the same number
er trees not sprayed, of the same varieties, and grown under the same
ions. Yours very truly,
Jonathan Case.

(Iredell County) Mooresville, N. C., November 20, 1911.

R SIR:—One of the two sprayed trees died from lightning—the other one
ed fruit to ripen—not a good crop, but good for this year as we had
ittle fruit. The one half-sprayed had some fruit on treated half—the
half nearly dead, no fruit at all, foliage not half as large, nor as much
nor as vigorous.
I firmly convinced that it pays to spray. Will try the lime and sulphur
spring. Yours, H. C. Johnston.

(Jackson County) Sylva, N. C., October 8, 1908.

R SIR:—The sprayed apple trees show the benefits of spraying more defi-
now than they did in July. At this date (October 8) the foliage and
re far better than other trees (unsprayed) of the same variety near by.
have had several hard frosts this month, yet the foliage is still green,
int, and dense; the apples are cleaner, larger, and still growing. The
d trees are very much better in every way.
Yours respectfully, George P. Miller.

(Johnston County) Clayton, N. C., November 23, 190

Dear Sir:—The foliage is still large on the trees that were sprayed. On tree that was half-sprayed the sprayed foliage is large, while on the unspra half there is scarcely any. The fruit was some larger and the yield was s greater. The tree whose fruit has always rotted did not have many, but t remained until they ripened; the fruit was smooth and nice, and I am pleased with the spraying. Respectfully,

W. T. Stalling

(Lincoln County) Reepsville, N. C., October 14, 190

Dear Sir:—The tree that you sprayed all over was not a fair test, as of it died this summer and the other part is not healthy. The tree that half sprayed and half not shows marked difference, the leaves on spra side being green and more free from rust than the unsprayed. We gath some as fine Blackburns off a tree that you sprayed as I ever saw, and had no worms. Everybody that has seen the apples off sprayed and unspra trees say that it pays to spray. The people around here have taken an in est in spraying their fruit trees. Very respectfully,

D. C. Warlic

(McDowell County) Old Fort, N. C., November 23, 190

Dear Sir:—Have waited for full developments to report, and have as several neighbors and friends to express opinion, and they readily agree me that there is profit in spraying apples. Apples are prettier, larger, smoother than before. The tops of the trees not reached did not have as fruit. Leaves kept green longer than on the other trees. The greatest ference was seen in the tree only sprayed on one side, both as to fruit foliage. Neighbors have asked for apples to show inquirers. All are plea with results. The fruit is much nicer. Yours truly,

H. M. Croo

(Mitchell County) Spruce Pine, N. C., October 24, 190

Dear Sir:—Our fruit was a total failure (frost and freezes), only one a from about 200 trees. I could see a slight difference in foliage of t sprayed; it seemed a little darker than on the unsprayed. There are no g apples within eight miles of this place this year.

Yours truly, H. F. Lawrenc

(Robeson County) Red Springs, N. C., October 23, 190

Dear Sir:—The foliage on sprayed trees is green now; on the other t about all off. The fruit stayed on until ripe and we used it. [Had alw rotted prematurely before.—F. S.] The apples on the half-tree that sprayed were about twice as large as on the half unsprayed, and were m free from worms, rot, and better in every way. I certainly think spra pays. Yours, etc., W. M. Robert

(Rowan County) Salisbury, N. C., October 22, 191

Sir:—On the tree that was half sprayed the apples were larger and foliage seemed to stay on better. The apples did rot considerably, but no bad as on the half not sprayed. As to the others, the leaves stayed on be but I can't tell any difference in the apples—they rotted as bad as ever, b didn't think they were as wormy as in other years. Yours truly,

M. J. Bos

(Rutherford County.)

(Note.—This is another of the few cases where no noticeable benefit reported.)

Rutherfordton, N. C., November 22, 190

Dear Sir:—I am sorry to have to report that I see no benefit derived f the spraying. It might have been owing to the late spring frost or o natural cause that I am unable to account for.

Yours very truly, M. O. Dickerso

(Scotland County) Laurinburg, N. C., December 10, 1909.

AR Sir:—The tree that was half sprayed died and the fruit did not ma-
I can only say that the foliage on the sprayed half was better, and the
—what there was of it—was larger and healthier than the rest. The
that was sprayed was the last to die. The other small tree died out
letely, and bore no fruit at all. The large tree was all right and as
r as you ever saw, but had only a very few apples on it, but these were
than it ever bore before. This tree is living and looks well. The trees
e orchard were beginning to blight when you came, and it seems that you
e the wrong ones. The large tree held its fruit until it was fully ripe—
hing it never did before. Very truly,

W. DeB. McEachin.

(Stanly County) R. 3, Albemarle, N. C., October 13, 1910.

DEAR Sir:—The Winesap apple tree that you sprayed for me still has
l bushels of nice apples on it, the leaves still have the rich, healthy color,
another Winesap tree of same age standing beside it (not sprayed) shed
3 apples more than a month ago.
tree which was half sprayed showed a marked contrast in quality of
also, there is quite a contrast in foliage. I have a spraying outfit, and
l to spray thoroughly next year.
nking you, Yours truly, D. P. Whitley, M.D.

(Stokes County) King, N. C., October 7, 1908.

R Sir:—The foliage and fruit on the Winesap trees were fine—the fruit
t perfect, and the foliage at this writing (October 7th) is fresh and
On the Maiden Blush tree the fruit was fine, but did not keep as well
should have done. I sold three bushels to a canner, and they told me
were the only apples they found with no worms in them. Foliage on
ee is now fresh and green. Two other trees of the same variety, right
the one sprayed, have foliage all off, and did not get an apple from
one fit to use.
Magnum Bonum tree—half sprayed and half not—showed marked dif-
e in the fruit on the sprayed side; the fruit on the side that was sprayed
uch larger and finer. The foliage on that side is now fresh and green;
side not sprayed, nearly all off.

Respectfully yours, J. W. Spainhour.

(Yadkin County) Courtney, N. C., November 14, 1911.

R Sir:—I noticed no difference in the quantity of apples but vast differ-
n quality. Fully 90 per cent on sprayed Ben Davis tree ripened without
ng, free from worms, while not 10 per cent of them matured on un-
d trees. The same was true of the half-sprayed tree. The foliage re-
l green on sprayed trees until killed by the last freeze, while unsprayed
were barren of their foliage. Had I spent $40 or $50 for spraying ma-
and work I would have realized several hundred dollars from my
d this season, whereas I only received a few dollars.

Respectfully, D. T. Reavis.

(Yancey County) Bald Creek, N. C., October 27, 1910.

R Sir:—I can truly say there is no comparison between the sprayed
nd those not sprayed. The bulk of my apples were killed by the last
in spring. Where we did not spray they almost all fell off, and what
t were spoiled by scab; on the trees that were sprayed, what fruit was
led by the freeze hung on well and was smooth and nice, with few de-
and the foliage is still green. Same on the half-tree that was sprayed,
the half not sprayed the leaves and apples both dropped off. I am fully
d. The only road out is to continue to spray—and spray heavy at that.
n best regards, Yours, etc., C. L. McPeters.

Discussion of These Results.— It will be seen that of all the reports two or three indicate disappointment, and the two things which proved troublesome to the tests were the late frosts and the tendency of apples to in early fall. The rotting of fruit in early fall can be controlled largely summer spraying, as indicated on page 8. But in all of these demonstrat we have depended only on spring treatments, and have never given a sum spraying. The latest date on which any of the trees in these demonstrat were sprayed was May 29 (at Old Fort, in 1909). We cannot expect a sp ing given at that early date to completely protect the fruit from rot in August and September, so that occasional partial failure on that point is t expected. Yet even with these spring treatments the majority of reports s that the sprayed apples rotted very much less than those not sprayed.

The two men who report absolutely no noticeable benefits are Mr. J Hodges, of Mocksville, and Mr. M. O. Dickerson, of Rutherfordton, bot 1909. It may be that we did not reach these places at just the right tim give the treatments to best advantage. Many of our sprayings have given either just before, during, or immediately after heavy rains. In matter of hitting *exactly* the right time, the fruit grower on his own p can do better than we, who must make our trips to suit a number of diffe varieties in different localities. Only two complete failures from so m tests is very gratifying.

Then, too, these few failures will serve to show us that spraying isn't *fect*—that it won't do everything. There will come times when the ap will rot or the Codling Moth will be destructive in spite of the most ca spraying. We must acknowledge some limitations. But the great poi that, taken year after year under all sorts of conditions, spraying can g ally be relied upon to protect our trees and fruits from the majority of enemies—and the results are very, very profitable.

The persons who made reports were all persons who had not been in habit of spraying, and most of them had never before seen a spray pum use. That they were fully convinced is shown by the fact that a numbe them have since bought up-to-date spraying outfits and are now spraying trees regularly.

It would be easy (too easy to be worth while) to secure the testimon dozens of progressive fruit-growers to the effect that they could not mai their commercial orchards profitably without following a well-planned sp ing schedule. The value of the letters here printed lies in the very fact these men were not experienced in spraying and that their education in matter came purely from these public demonstration sprayings. In se cases they seemed decidedly skeptical of the value of spraying, regardi as a sort of "theoretical experiment," until the results convinced them

PART 3—SPECIAL NOTES WITH REFERENCE TO WAR CONDITIONS

d shortage and high prices for food prevail everywhere. Every one that food production must be very greatly increased in 1918, in order oid actual calamity. While emphasis is rightly being placed upon the r foods (grains, beans, etc.), yet for the fruit-grower the duty is plain ke every tree do its best.

:hes brought good prices in 1917, and apples have been high through inter of 1917-18. As orchard fruits can be either consumed fresh or ved by drying, canning, etc., and as fruits, jams, jellies, and preserves nsidered staple foods (even used by the armies and navies), there is reason to expect that high prices for fruit will continue.

ver Spraying as a measure for increasing the fruit crop, improving its v, and increasing its shipping and keeping powers, is decidedly an im- t, patriotic, war-time duty of the fruit-grower. Hence the State Agri- al Extension Service is especially anxious that every fruit-grower shall his orchard this year (1918), and if this be well done we feel assured ie grower will make a larger profit and from this will learn how to keep hard profitable in the years to come.

:e is no time to lose. This Circular is intended to be issued in April , and by that time the spraying season will be far advanced. Other itions on this same topic have been widely distributed in former years, ring this winter all County Agents and many fruit-growers have already d advice through correspondence, publications, or in person. The fruit- should have secured his outfit before the time this Circular is dis- d, but if not, he should get it with the least possible delay (also the materials) and take up the spray schedules here recommended as soon can.

ORCHARD SPRAYING CAMPAIGN FOR 1918.

ouncement and Request. The writer intends to follow up the orchard ng campaign as closely as possible through this year. We wish to be show at the close of the season 1918): (1) How many persons have up spraying who had not sprayed before; (2) Number trees sprayed by ersons; (3) How many County Agents conduct spraying work in their s; (4) Number orchards in which demonstrations are given; (5) r trees treated in demonstrations; (6) Number fruit-growers inter- , consulted, instructed or addressed by representatives of the office on ject of spraying, and finally (7) We hope to be able to give some re- igures as to the increase in fruit (amount and value) that is secured as t of the efforts of 1918.

ecure these results we ask the co-operation of County Agents, and of it-growers who begin spraying this year as a really definite part of their ons. *Write us, so we can list you as one of our co-operators for the* D CAMPAIGN OF 1918.

not continue the campaign through the years to follow, until spraying ecome universal among our fruit-growers?